TABLE 1.—*Showing the Increase in Number of Borrowers and Items Loaned from the State Medical Library from October, 1932, to June, 1934*

	Los Angeles			San Francisco		
	October 1932	June 1933	June 1934	October 1932	June 1933	June 1934
Number of borrowers	93	291	334	64	316	412
Items loaned (books and journals)	67	493	538	211	556	490
Number of communities served	22	65	67	29	75	95

items loaned by the State Medical Library are retained by the physician borrowing them for an average of five days. With packing, mailing, and return, an average of nine days per item is consumed before the next borrower may be served through the same item. After circulation, periodicals are filed and preserved. Back numbers of periodicals become available for special consultation. Adequate reference files are now available at both offices for all ordinary requests. Special reference facilities are furnished through the courtesy of the University of California Medical School Library.

GIFTS TO THE LIBRARY

During the past year many gifts have come to the State Medical Library from physicians interested in its welfare. The late Dr. Le Roy Crummer of Los Angeles presented jointly to the State Medical Library and the University of California Medical School Library over 100 rare and valuable medical classics, particularly of the sixteenth century. Two important incunabula were included in this gift. Doctor Crummer also gave the Library over 200 rare medical prints and engravings, which form the basis of a catalogued iconographic collection of some 800 items. Mr. H. W. Sheldon of Berkeley gave 375 volumes from the library of his father, the late Dr. H. W. Sheldon. Over 500 volumes have been received in exchange through the American Medical Library Association. They have been deposited as a working reference library in the Los Angeles office. A very large collection of reprints has also come to the Los Angeles office, where they are being classified and arranged to serve as the basis for a packet library service.

COÖPERATION WITH LANE AND BARLOW MEDICAL LIBRARIES

An effort has been continuously made to coöperate fully with the two private medical libraries in the state, the Lane Medical Library in San Francisco and the Barlow Medical Library in Los Angeles. Wherever possible, physicians are urged to contribute toward the support of these private libraries, and in return to make use of their facilities. The financial circumstances of medical practice are making it more and more difficult, however, for individual physicians to contribute toward the support of these private medical libraries. The demands upon the State Medical Library may, therefore, be expected to increase.

IN CONCLUSION

Surprisingly little difficulty has been experienced in the relations of the State Medical Library with its users. In only one instance has there been undue delay in the return of borrowed items. For this wholehearted coöperation on the part of its borrowers, the State Medical Library is very grateful. It can only function smoothly when everyone using it has a due regard for others who may desire to use it also. As far as possible with the funds available, the State Medical Library is attempting to meet the needs for which it was created. Suggestions and criticisms regarding improvement in its services are always welcome, and will be respectfully considered. At present the chief problem is to conserve to the utmost the funds remaining, in order to maintain the service as long as possible.

University of California Medical School.

HEAT PROSTRATION—ITS TREATMENT AT BOULDER DAM*

By RICHARD O. SCHOFIELD, M. D.
Boulder City, Nevada

DISCUSSION *by Eugene S. Kilgore, M.D., San Francisco; C. Van Zwalenburg, M.D., Riverside; Fred S. Modern, M.D., Los Angeles.*

MAN is able to live and work under great extremes of existing conditions. The work at Boulder Dam in the summer presents an opportunity to see the reactions of man to high temperatures in the presence of low humidity. With these atmospheric conditions there also is added the fatigue due to physical activity, and the combination of all of these factors oftentimes gives rise to impairment of bodily functions to the point of syncopy or heat exhaustion.

INITIAL EXPERIENCES AT BOULDER CITY

When the dam-building project was first started, men were forced to work and live under the most trying circumstances on a hot desert where no conveniences were available. They were poorly housed in tents or in crude shacks, or slept out in the open. The food was of the ordinary camp style and variety, and was prepared and served accordingly. The water was not palatable and was hot. There was a complete lack of facilities for resting or recreation. These conditions made it

* Read before the General Medicine Section of the California Medical Association at the sixty-third annual session, Riverside, April 30 to May 3, 1934.

almost impossible for their physical conditions to be up to par, which, combined with the intense heat and low humidity, made for greater susceptibility to heat exhaustion. The summer heat had an average daily maximum temperature of 119 degrees, and an average mean daily temperature of 106 degrees.[4] These were the conditions present during the summer of 1931 at Boulder Dam, in which there occurred possibly 150 cases of heat exhaustion. The usual clinical picture was presented, of pallor, nausea, vomiting, muscle cramps, diarrhea, and unconsciousness.

Many deaths occurred before any aid could be offered. Facilities for care were not the best, yet many recovered after having their bodies cooled by being wrapped in wet sheets, and given rest while in perhaps some shaded spot. Seventeen deaths occurred this first summer.

THE BUILDING OF BOULDER CITY

Following this terrific death toll, we find that Boulder City was built and became a veritable oasis in the desert. Here were provided clean, artificially cooled and well-ventilated dormitories; a great variety of food was made obtainable, which was prepared and served in an appetizing fashion in cool, ventilated dining rooms. An abundance of good water, refrigerated to any desirable temperature, was to be had at almost any point on the project. An artificially cooled movie theater was constructed and well-planned recreation halls were built. First-aid classes were organized to instruct men to watch themselves that they might avoid the effects of extreme heat; they were made to realize that they should stop work when feeling the first effects of heat, instead of trying to continue in the face of danger. They were urged to drink water more freely. The summer was comparatively a cool one, with an average daily maximum temperature of 107 degrees and a daily average mean temperature of 96 degrees.[4] The good condition and well-being of the men, plus first-aid instruction and a moderately cool summer, showed its effects in that no severe heat exhaustions occurred. There were recorded only seven mild cases in which hospitalization was necessary for the patients, all of whom recovered.

BOULDER CITY STUDIES ON HIGH TEMPERATURE EFFECTS

It was during the summer of 1932 that Bock and Dill[1] conducted their research at Boulder City in which they found that physical activities in high temperatures produced great losses of chlorids, as well as water from the body. This loss occurred by sweating. The greatest loss of sodium chlorid took place during the first few days of exposure to high temperatures. During this time the blood chlorids remained at a relatively constant level, and this level was maintained at the expense of the chlorids in the tissues. They called attention to the facts established by Cohnheim, Kreglinger and Kreglinger[2] that a healthy subject is not able to retain water in the body without the presence of sufficient salt in the tissues. It would follow, therefore, that the mechanism of heat exhaustion is that in which the initial disturbances are manifested by muscle cramps due to an actual depletion of chlorids in the tissues, or, to the creation of an imbalance of the sodium, the potassium, and the chlorids.[3] Further disturbances produce syncopy, which is due to an actual lowering of the total blood volume.

The summer of 1933 presented a daily average maximum temperature of 112 degrees and a daily mean average temperature of 104 degrees.[4] Men were constantly urged to drink more and more water, and were directed to use table salt freely—at least one teaspoonful per day. There were thirteen cases of heat exhaustion, nine mild and four severe, and one of the patients was *in extremis.* Considering the very good condition of the men, and the general endeavors made to prevent the occurrence of any heat cases, it is probable that only in one case was the manifestation of heat exhaustion as bad as those encountered during the first summer when seventeen deaths occurred.

CLINICAL MANIFESTATIONS OF HEAT EXHAUSTION

Clinically, heat exhaustion may be manifested in either of two ways: (*a*) The hyperpyrexia patient, whose temperature is upward of 105 degrees, and whose body surface is burning up. First-aid treatment here consists of wrapping the body in wet sheets and packing in ice. (*b*) The subnormal temperature patient, whose body is cold and clammy, and in which the first-aid treatment is that of shock, by the application of warmth. In both types there occurs vomiting, diarrhea, muscle cramps of the skeletal muscles, nystagmus, tossing of the head and body, and unconsciousness. Respirations are rapid and shallow; the pulse is rapid and thready; the blood pressure may be so low as to be unobtainable.

TREATMENT

Prompt care by first-aid attendants is of utmost importance. Treatment consists of restoring normal body temperature by the continuous application of the warmth or the cold, by supplying the needed fluid to a dehydrated body, and by restoring the chlorid balance to the tissues.

Previously, attempts were made in treatment by giving normal saline hypodermoclysis, together with an intravenous solution of 20 cubic centimeters of 10 per cent saline. This concentration proved, at times, to have produced a severe reaction. From that type of treatment we have gradually acquired a therapy by feeling our way along with each case as it presented itself. For intravenous therapy, we are now using normal saline in 7½ per cent glucose solution. This was first given in one liter amounts. Subsequently we have increased the amount. The last case treated was clinically the most severe. In this instance, during the first one and one-half hours we gave, intravenously, 2,000 cubic centimeters of normal saline in 7½ per cent glucose solution, followed in two hours by 1,000 cubic centimeters normal saline by hypodermoclysis, followed four hours later by 800 cubic centimeters intravenous, normal saline, and this followed in six hours by 1,000 cubic centimeters normal saline by hypodermoclysis. Restlessness and vomiting ceased during the first hour, and consciousness returned in two hours. Fifteen grains of sodium chlorid was then given orally in four ounces of water every four hours. Stimulants of strychnin and caffein were used hypodermically. Ice water enemata were used, as was also continuous external application of cold in the form of ice compresses. The patient quieted down quickly with this therapy and recovered.

It is questionable whether introduction of body fluids could be maintained at this pace in all instances, but the above procedures indicate to what limits this therapy has been extended.

SUMMARY

1. Improvement in living conditions at Boulder Dam, plus preventive measures which encouraged the drinking of more water and the use of more salt, probably have decreased the number of heat cases that occur.

2. Clinical manifestations of heat exhaustion are first evidenced by the disturbances due to the depletion of the chlorids in the tissue cells (muscle cramps), and later by a decrease in total blood volume (exhaustion).

3. Treatment should not only restore the body fluids which have been lost by excessive or prolonged sweating, but should also include a restoration of the chlorid balance to the tissues.

4. The data available in one season for the prevention of heat cases, or in the successful treatment of those that did occur here at Boulder Dam, should not suffice for the determination of any set procedures. Further observation should be made to substantiate the validity of both the prevention and the treatment programs.

Boulder City.

REFERENCES

1. Bock, A. V., and Dill, D. B., Ph.D.: A Résumé of Some Physiological Reactions to High External Temperature, New England J. Med. (Oct. 31), 1933.

2. Cohnheim, O., Kreglinger and Kreglinger: Beitr. z. Physiol, des Wassers und des Kochsalzes, Ztschr, f. Physiol. Chem., 63:413, 1909.

3. Personal communication from D. B. Dill, Ph.D., 1933.

4. Computation made from United States Government temperature recordings for the month of July.

DISCUSSION

Eugene S. Kilgore, M. D. (490 Post Street, San Francisco).—Doctor Schofield's contribution well illustrates the application of physiology to a clinical problem, with most gratifying results. Interesting in itself, it is the more so because of its newness and also its oldness. The emphasis on salt and water in the treatment of heat exhaustion is new to clinical medicine. Standard medical textbooks do lay stress upon reducing the hyperpyrexia; they mention fluid administration, though with inadequate appreciation of the quantity needed; they generally ignore sodium chlorid; and, in the spirit of times now happily passing, they put the emphasis on treatment by drugs, especially stimulants. But the prophylactic use of sodium chlorid is old—outside the ranks of orthodox medicine. I am told that for a long time slightly salted drinking water has been supplied to the crews of British vessels in the Red Sea, and that they probably adopted the practice from the Arabs, who have followed it from time unknown. Perhaps Christ had in mind more than the gustatory effect when he referred to his followers as "the salt of the earth"; and the credit for the discovery of the importance of chlorid depletion and replacement prophylaxis may belong to some much earlier desert dweller, who tasted the whitish deposit left on the skin by evaporating sweat.

Doctor Schofield's paper deals admirably with the emergency treatment and the immediate, essentially emergency, prophylaxis of heat exhaustion. The slow process of adaptation to torrid conditions is, of course, outside the scope of his present report. This also is a promising research field. It has been partly explored by modern scientists (they have found, inter alia, that in artificial tropics mice increase their cooling surface by growing longer tails, larger ears, and pendulous, hairless scrota), and again, partly *experienced* by ancient, unknown but certainly unorthodox observers. Old descriptions of the marauding nomads of Central Asia, whose success in plaguing Persian towns depended upon the speed and endurance of their horses in the desert, state that in order to toughen the animals they regularly allowed them very little water. Herein is the suggestion that there may be a period preliminary to exposure to dangerous heat when the body may profitably be inured to economy in the use of water—a preparatory management exactly opposite to that which Doctor Schofield has found so beneficial in the actual pinch. It is a suggestion worth the attention of the physiologists, and might lead to a discovery of greater value than those on the measurements of the mice.

C. Van Zwalenburg, M.D. (308 Citizens National Bank Building, Riverside).—In discussing this paper, I wish to emphasize especially dehydration. This is such an essential part of the problem of heat exhaustion that I should like to have the entire profession, and particularly the public generally, consider it almost entirely a dehydration. The demand to replenish this loss of water, as both a preventive and as a cure, appears to me the all-important point in the control of heat exhaustion and sunstroke.

The only protection against excessive heat the body has is the vaporization of water from its surface. Your patient is practically dying from thirst. Fill the blood vessels with fluid. Heat dilates the capillaries, and there is a consequent pouring out of fluid; and the higher the humidity the greater the outpouring of water in the form of sweat in the effort to cool the body—ten, even twenty pounds in one day. Dehydration is evident.

At Boulder Dam, as Dr. Schofield has told you, the instruction to the workers, which goes out constantly, is to drink, drink. Placards at drinking fountains, instructions at weekly first-aid meetings—everywhere people know that they should drink water and, best of all, good drinking water is made easily available. To my mind, Dr. Sansum's letter to President Bechtel in 1931, urging the use of water, should be given much credit for the reduced number of prostrations.

Of course, the demand for chlorids is well understood, and should not be left out of the picture; but for practical purposes, the use of water seems the obvious point of emphasis.

To me the demonstration, that lack of chlorids is alone the cause of miner's heat-cramp, is still incomplete. Intermittent claudication is clearly due to lack of blood in the leg on account of an arteriosclerosis occluding the artery. Why is not a lack of fluid to fill the blood vessels the cause of heat-cramp?

It seems to me of the greatest importance that we inform the public that the prevention of heat exhaustion and sunstroke lies in the drinking of large quantities of water. It was most trying to read of the appalling number of prostrations all over the country last summer, and not to be able to rush the information to the suffering public that the simple use of water—water—any kind of good water, would prevent these prostrations. The loss of salt is enormous. Taste your arm on a hot day on the desert. Persons exposed to high temperatures for a long time must, of course, replenish the salt lost; but for practical purposes, for the casual exposure, water in large quantities is the remedy.

And, for treatment, intravenous salt solution is just as truly a life-saver as in surgical shock or any other kind of dehydration.

This method has now been used in approximately 150 cases, to my knowledge, at Indio, Berdoo Camp, Imperial Valley, and at Boulder Dam, and the results from all reports are so striking that we are anxious to broadcast it to the profession that practically heat exhaustion is dehydration, and that the remedy is fluid intravenously as long as the patient cannot take it in any other way. This remedy is so simple and so obvious, once our attention is fixed upon it, that it should not be overlooked any longer: vaporization to reduce heat—the pouring out of fluid for vaporization. Heart and blood vessels empty. Death from bleeding into and through the skin. Simple mechanics. Fill the blood vessels. And, for prevention—drink, drink.

Already the general knowledge of the need of more water is spreading. More water is being used, and the lower incidence of heat exhaustion in Imperial Valley last summer (1933) has also been asserted to be, at least in part, due to this publicity. Doctor Schofield has told you what it has done at Boulder Dam.

Fred S. Modern, M. D. (1135 Pacific Mutual Building, Los Angeles).—The syndrome of heat exhaustion that Doctor Schofield describes represents the failing adaptation of the human organism to high temperatures and low humidity. He segregates two main types: one with a dry skin and high fever, and the other with clammy skin and subnormal temperatures. Common to both types are vomiting, diarrhea, muscle cramps, nystagmus, and unconsciousness. Except for heating or cooling of the body, the treatment is essentially the same: that is, the administration of large amounts of normal saline with glucose intravenously, NaCl orally, and stimulation of the failing circulation.

As Doctor Schofield points out, the primary pathological faults lie in the dehydration and depletion of the NaCl stores of the tissues. Which of the two losses is the primary one, and more deleterious, cannot be determined at present without further investigation.

Frederick M. Allen, who advocated the use of a salt-poor diet in the treatment of essential hypertension, has observed that a small number of patients, so treated, developed signs of "salt privation." These signs, namely, pallor, restlessness, loss of appetite, weakness, irritability, and muscle pains, particularly if the calf muscles are essentially the same as Doctor Schofield described, except that they are milder. The daily administration of 2 grams of NaCl to the diet abolished the symptoms in a few days. We find a somewhat similar picture in pernicious vomiting associated with alkalosis.

It would be instructive to follow the CO_2 combining power of the plasma in these patients from coma to recovery. If it is the loss of the chlorids which produces the symptoms, then there should be a progressive decrease; while if it is due to the loss of the neutral salt or the base, there should be no striking change, or there should be an increase in the alkali reserve.

Doctor Schofield's paper is valuable not only for the importance of his clinical and therapeutic observations, but also for the theoretical questions that his presentation raises, and which demand to be answered.

NON-ORGANIC CONVULSIVE DISORDERS OF CHILDHOOD—WITH SPECIAL REFERENCE TO IDIOPATHIC EPILEPSY*

By Irvine McQuarrie, M. D.
Minneapolis, Minnesota

II†

TREATMENT OF IDIOPATHIC EPILEPSY

The therapeutic implications from the foregoing discussion regarding the etiologic factors in idiopathic epilepsy are obvious. However, all practical means of affecting the physiological state of the brain cells are very indirect, a fact which places a definite limitation on the degree of therapeutic success to be expected.

The central objective in the routine treatment of this disorder in the individual child is that of preventing seizures and providing, so far as possible, for normal development of his mental and emotional capacities throughout the entire growth period. Obviously, the immediate aim of all therapy is to remove or at least alleviate the causative abnormalities, so far as these can be identified. The variety of circumstances and agents capable of influencing the occurrence of seizures is so extensive that continuous search must be made for such factors, and repeated therapeutic trials may be necessary before success is attained. Because of the protean nature of the contributing or inciting causes, there is perhaps no other clinical disorder that requires so high a degree of individualization in treatment as epilepsy.

Surgery has a very limited field of usefulness in the present-day treatment of idiopathic epilepsy. It is true that removal of greatly hypertrophied adenoids and tonsils, which obstruct the respiratory passages, and of certain "irritative" lesions, either within or outside of the skull, may be of benefit in the exceptional case. However, the radical operations on the skull, brain, and cervical sympathetics, sometimes advocated without special indications, are to be deplored. It would seem desirable some time in the future, when functional charting of the diencephalon has been completed, to test the efficacy of surgically produced diabetes insipidus in those severe epileptics whose seizures can be successfully prevented by stringent water restriction. The physiological state in diabetes insipidus appears on the surface to be almost ideal for the prevention of seizures in that a negative water-balance is always imminent.

The various aspects of the medical treatment of idiopathic epilepsy in children are schematically represented in Figure 5. The relative importance, which we would attach to the various available therapeutic measures, is indicated by the size of the sector assigned to each. Long experience has

* From the Department of Pediatrics, University of Minnesota, Minneapolis, Minnesota.

† Guest-speaker paper. Read before the general meeting of the California Medical Association at the sixty-third annual session, Riverside, April 30 to May 3, 1934.

Part I of this paper was printed in July issue, California and Western Medicine, page 1.